Are feeding traits and habitat responsible of microplastic ingestion in fish, crustaceans and elasmobranchs at the Western Mediterranean?

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Introduction

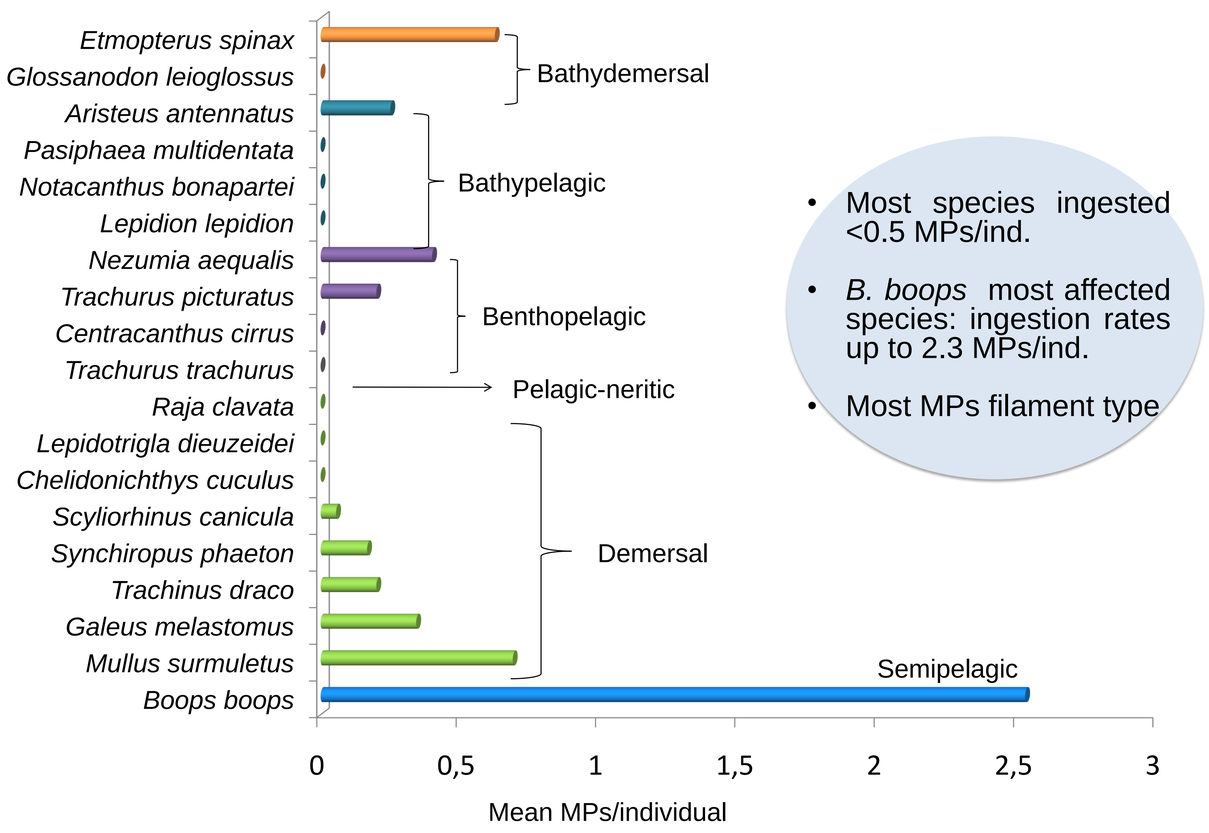
Microplastic (< 5mm) pollution in Mediterranean Sea is affecting pelagic and benthic fish species (1). Microplastic (MP) ingestion produces physical and chemical effects in species; monomers and plastic additives cause carcinogenesis and endocrine disruption. Microplastics serve as dispersal vectors for invasive species as well as bioaccumulative and persistent toxic substances (PBTs) causing ecological implications in organisms and potential threats across the food web (2).

Microplastics are available to organisms with different trophic strategies and feeding traits (3), which can ingest them randomly or selectively having implication along the food webs.

Aims

- ✓ **Analyse several key species of fish, crustaceans and elasmobranchs to assess microplastic ingestion in the Western Mediterranean**
- ✓ **Evaluate if species feeding traits and habitat determine microplastic ingestion**

Results



- Most species ingested <0.5 MPs/ind.
- *B. boops* most affected species: ingestion rates up to 2.3 MPs/ind.
- Most MPs filament type

Fig. 1- Mean microplastics (MPs) ingestion/ individual species with indication of main habitat

Species	n	Average	SE
Etmopterus spinax	8	0.40	0.05
Glossanodon leioglossus	5	0	0
Aristeus antennatus	4	0.26	0.09
Pasiphaea multidentata	1	0	-
Notacanthus bonapartei	4	0	0
Lepidion lepidion	2	0	0
Nezumia aequalis	10	0.33	0.10
Trachurus picturatus	5	0.22	0.08
Centracanthus cirrus	3	0	0
Trachurus trachurus	4	0	0
Raja clavata	1	0	-
Lepidotrigla dieuzeidei	4	0	0
Chelidonichthys cuculus	5	0	0
Scyliorhinus canicula	18	0.07	0.03
Synchiropus phaeton	6	0.19	0.08
Trachinus draco	5	0.22	0.08
Galeus melastomus	140	0.30	0.02
Mullus surmuletus	309	0.44	0.01
Boops boops	290	0.68	0.02

Table 1. Dispersion values within each species. n= number of individuals; Average= Distance-based test homogeneity multivariate dispersion (PERMDISP) calculated from the centroid; SE= Standard Error

Material and Methods

Field work

- ✓ Opportunistic sampling around the Balearic Islands, WMed
- ✓ November 2014 – June 2015, 12 locations, 20 – 756 m depth
- ✓ Different commercial and scientific vessels: bottom trawl, purse seine, trammel nets

Laboratory work

- ✓ Stomach content analyses of microplastic ingestion for **19 species**, **825 individuals** under stereomicroscope (Euromex NZ 1903-S) optical enhancement 6.7x to 40.5x
- ✓ Habitat classification: bathydemersal, bathypelagic, benthopelagic, pelagic-neritic, and semipelagic (fishbase)

Statistical analysis

- ✓ Permutational multivariate analysis of variance (PERMANOVA) to test significant differences among species microplastic ingestion/individual at each habitat
- ✓ Experimental design incorporated two factors: 'habitat' (fixed) with 6 levels and 'species' (random and nested in habitat) with 19 levels
- ✓ Data log + 1 transformed and Euclidean distance to build resemblance matrix
- ✓ PERMDISP calculated to analyze variability within each species

Main outcomes and discussion

- ✓ Significant differences in microplastic ingestion (PERMANOVA $p < 0.05$) among habitats with higher values in the semipelagic habitat (Fig. 1)
- ✓ High intraspecific variability within species at all studied habitats
- ✓ Microplastic ingestion by biota is an indirect estimation of marine litter loads. Biota act as a sink for microplastics, thus identification of microplastics in gastrointestinal tracts can indirectly reflect presence of this pollutant in the marine environment → differences in habitat could suggest different exposure to microplastic loads
- ✓ Ingested values of microplastic exhibit high dispersion within species such as *B. boops*, *M. surmuletus* and *E. spinax* and low variability in *S. canicula* (Fig. 2):
- ✓ **Functional traits of the different species (biology, autoecology, ethology) could determine microplastic ingestion, although high intraspecific variability might be linked to dispersion, re- distribution and fate of MPs in the marine environment (habitat)**

References

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